Evaluation of Brazos BBEST Recommendation on Yield of Cedar Ridge Reservoir

Presented to Brazos BBASC

May 30, 2012

Clear Fork Brazos River at Cedar Ridge Reservoir Dam - Full BBEST Recommended

Overbank Events		Qp: 10,260 cfs with Average Frequency 1 per 5 years Regressed Volume is 54,502 Duration Bound is 28		
High Flow Pulses	**HFP 5**	Qp: 5,829 cfs with Average Frequency 1 per year Regressed Volume is 30,584 Duration Bound is 24		
	HFP 4	Qp: 3,124 cfs with Average Frequency 1 per year Regressed Volume is 16,076 Duration Bound is 21		
	HFP 3	Qp: 144 cfs with Average Frequency 1 per season Regressed Volume is 928 Duration Bound is 15	Qp: 1,686 cfs with Average Frequency 1 per season Regressed Volume is 8,130 Duration Bound is 15	Qp: 1,281 cfs with Average Frequency 1 per season Regressed Volume is 6,509 Duration Bound is 16
	HFP 2	Qp: 34 cfs with Average Frequency 2 per season Regressed Volume is 209 Duration Bound is 9	Qp: 771 cfs with Average Frequency 2 per season Regressed Volume is 3,660 Duration Bound is 12	Qp: 510 cfs with Average Frequency 2 per season Regressed Volume is 1,890 Duration Bound is 12
	HFP 1		Qp: 239 cfs with Average Frequency 4 per season Regressed Volume is 1,124 Duration Bound is 9	Qp: 131 cfs with Average Frequency 4 per season Regressed Volume is 601 Duration Bound is 8
Base Flows (cfs)	**Wet**	17	16	12
	Avg	11	8	5
	Dry	7	4	1
Subsistence Flows (cfs)		1.0	1.0	1.0

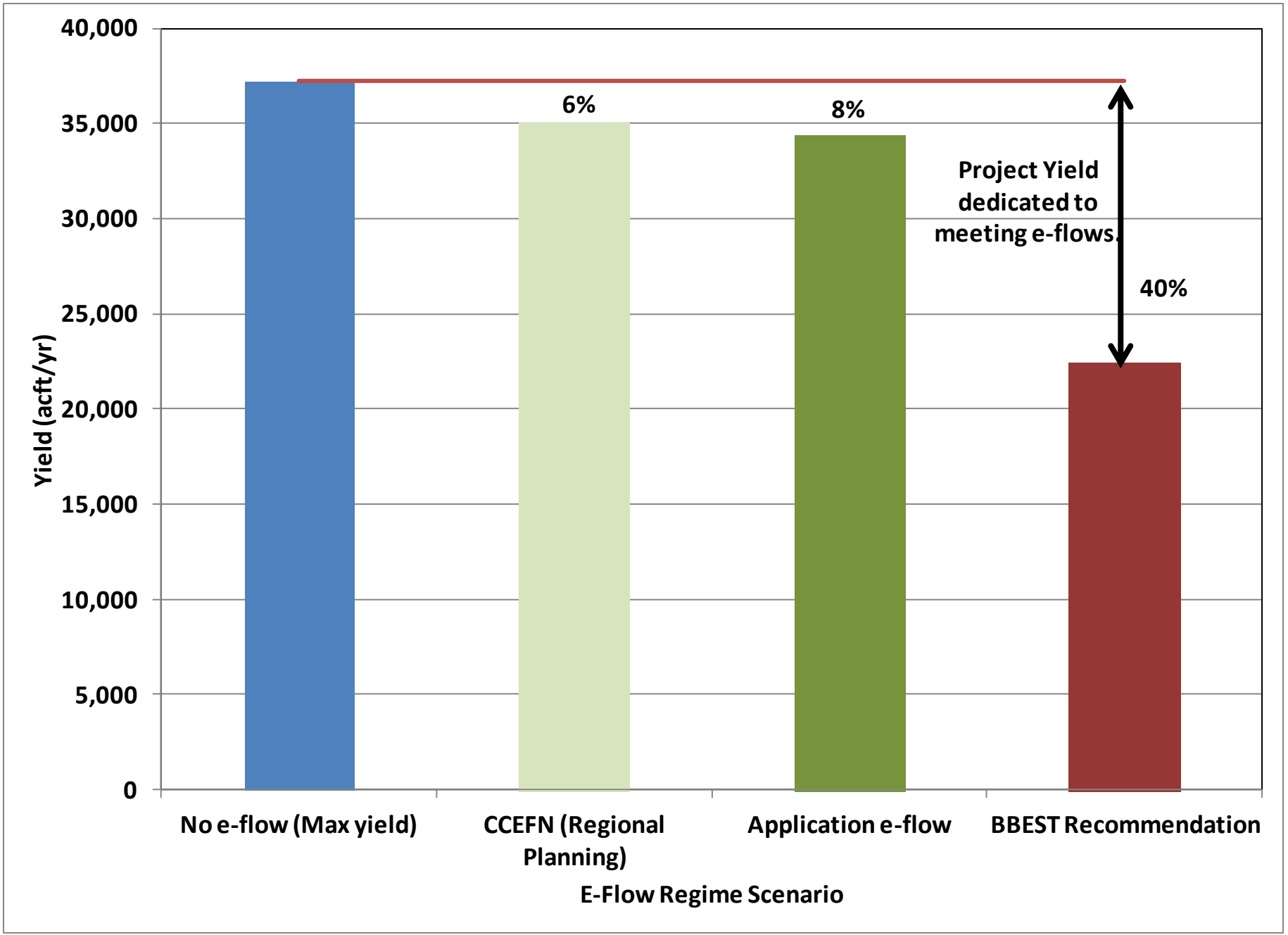
Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Winter				Spring				Summer			

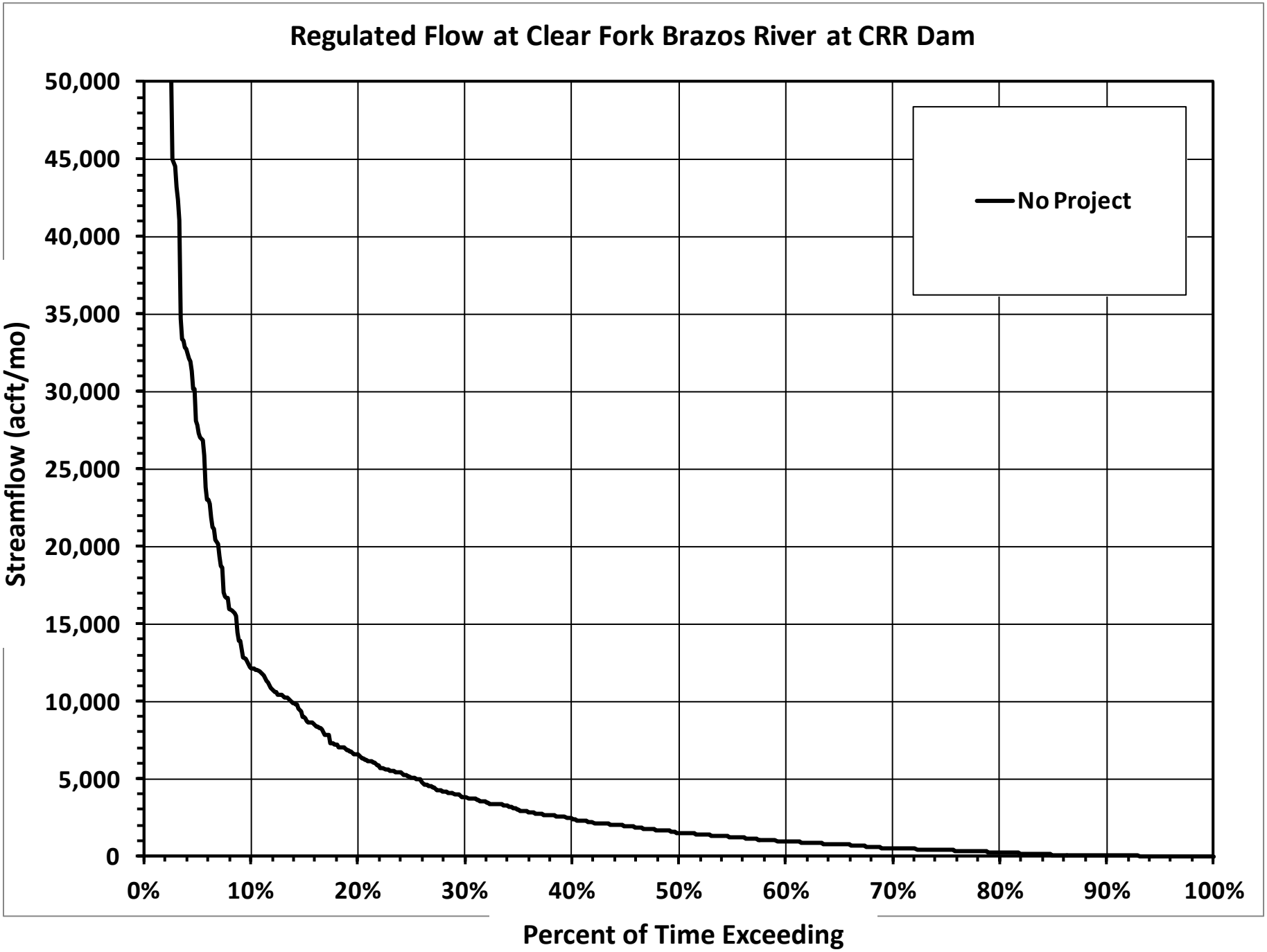
Flow Levels	**High (75th %ile)**
	Medium (50th %ile)
	Low (25th %ile)

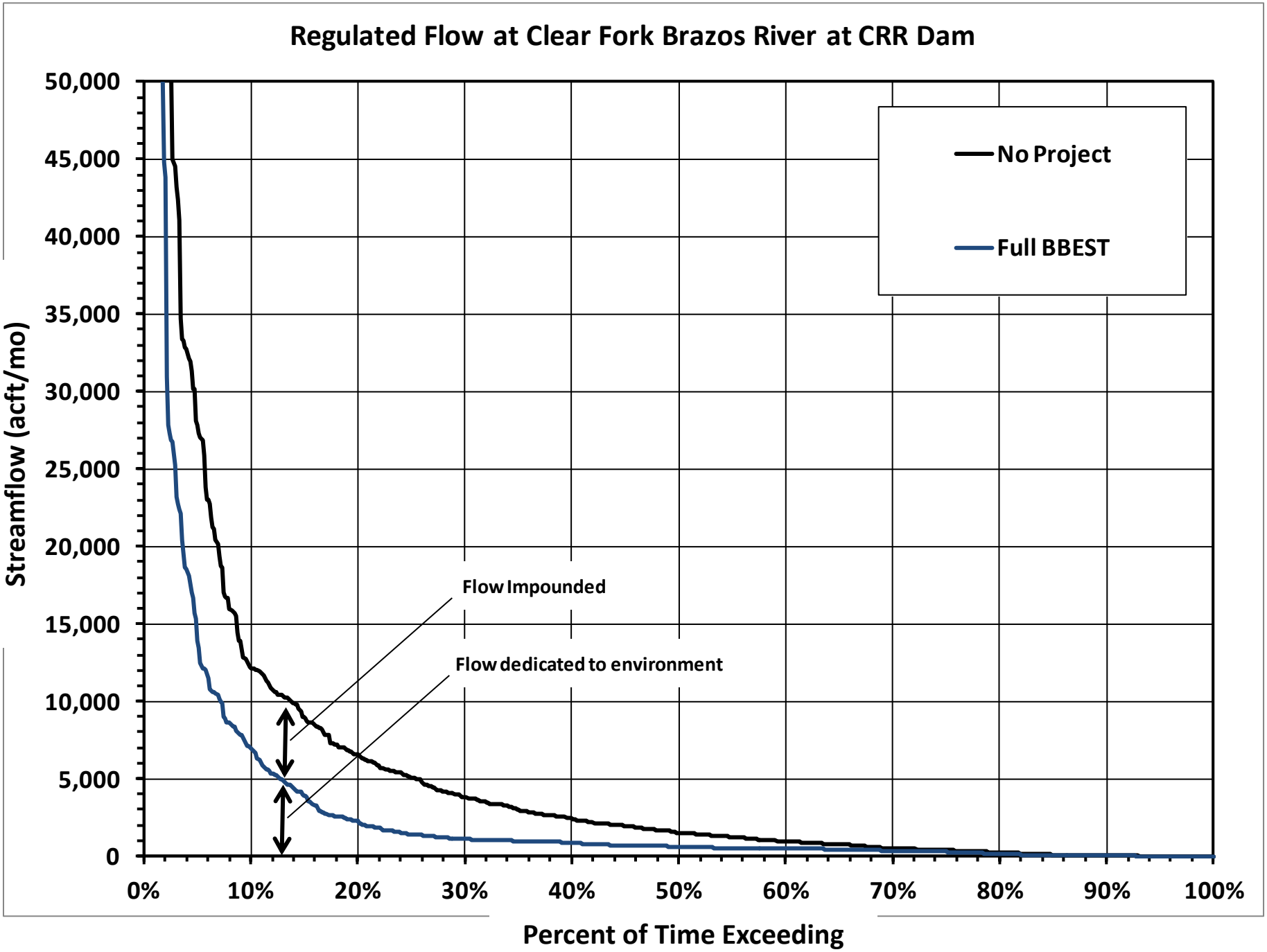
Notes:

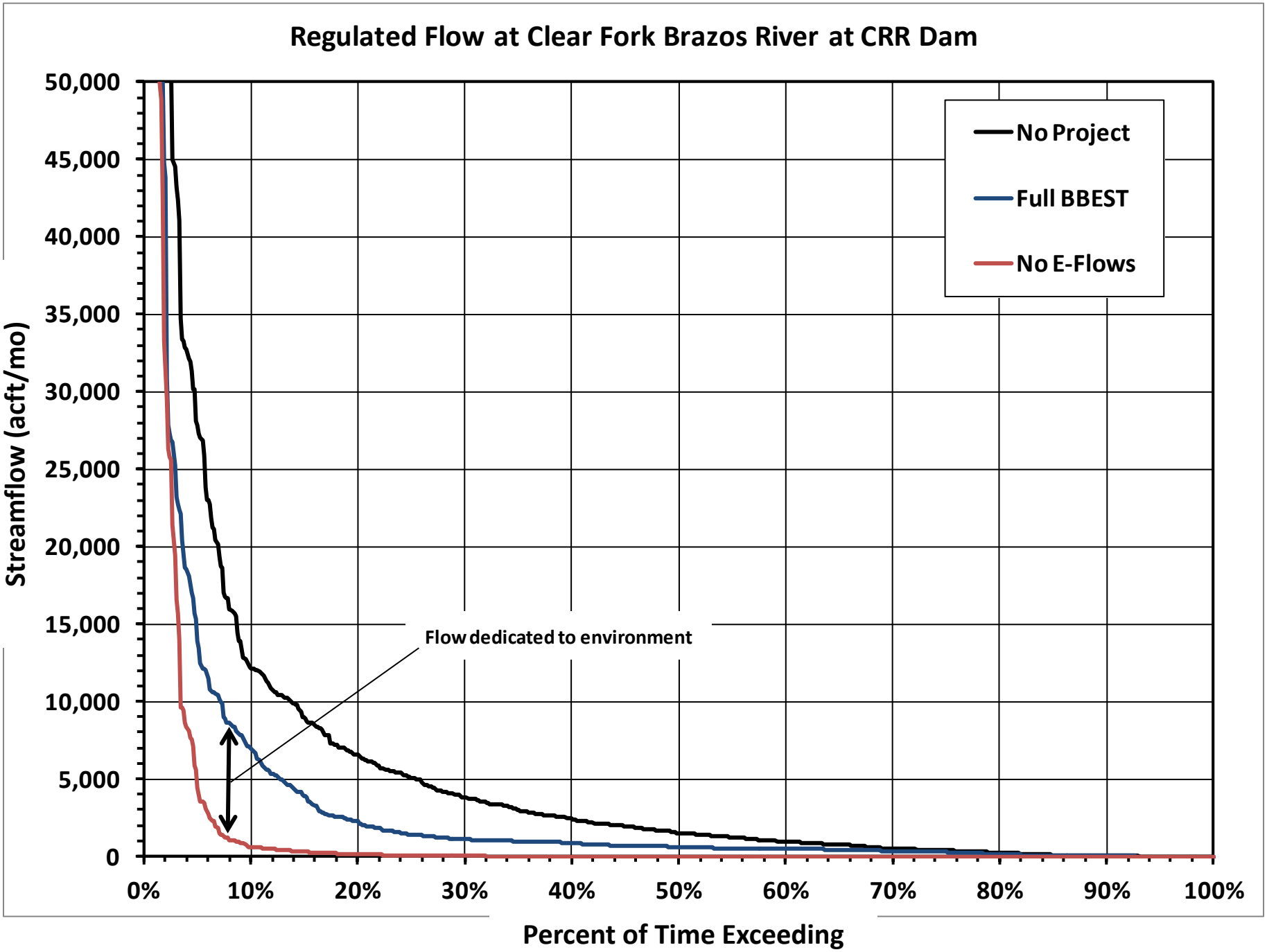
1. Period of Record used : 1/1/1925 to 12/31/2010.
2. Volumes are in acre-feet and durations are in days.
3. Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 6 cfs, or when the flow is below 29 cfs and the flow drops from one day to the next by less than 5%.
4. CRR values were calculated by translating BBEST Nugent E-flow criteria downstream to CRR dam site using a drainage area ratio of 1.307.
5. CRR E-flow criteria calculated from DAR with BBEST Nugent E-flow criteria were set to not exceed BBEST Ft. Griffin E-flow criteria.

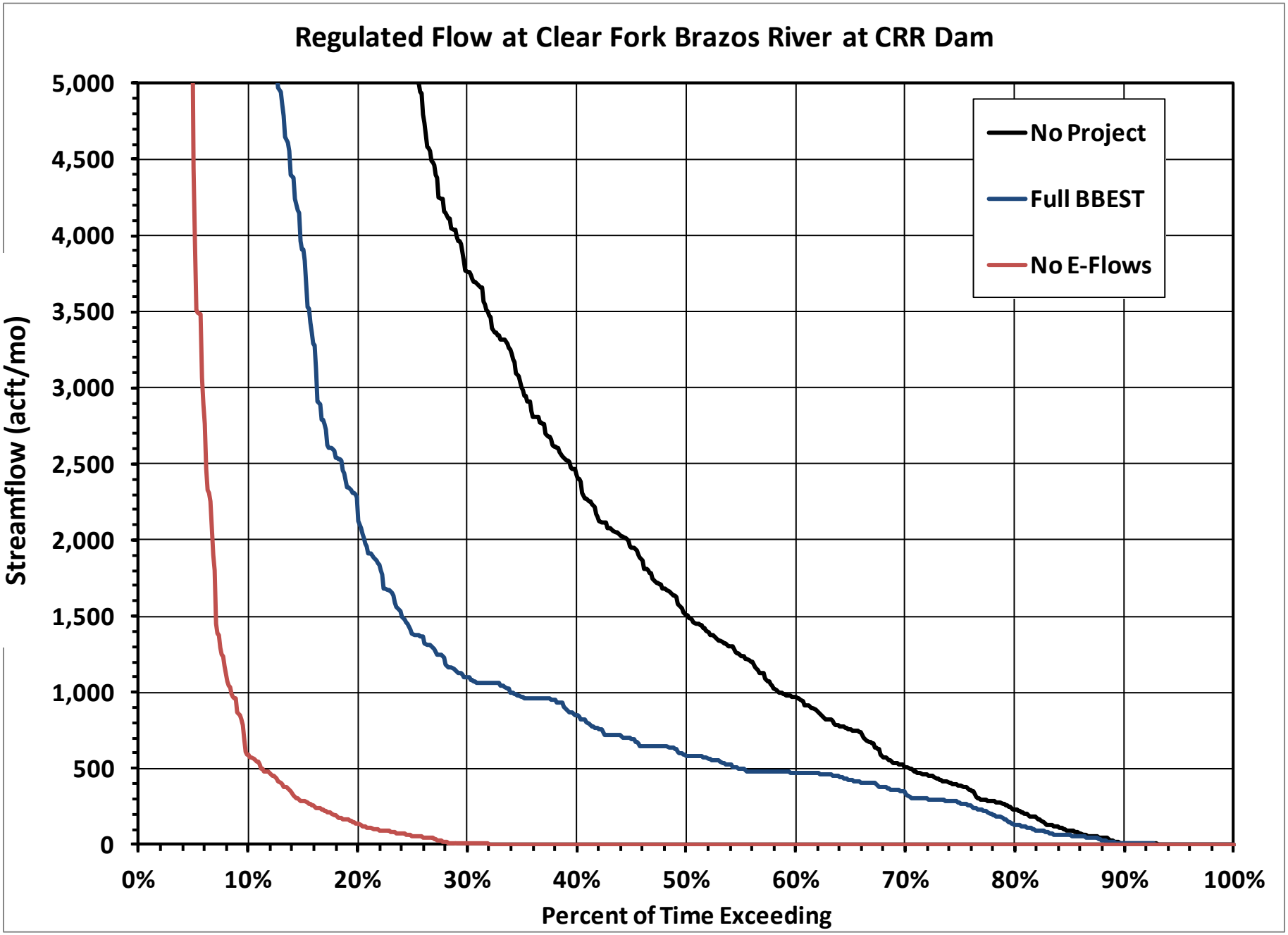
Yield Comparison for CRR




Regulated Flow at Clear Fork Brazos River at CRR Dam
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Streamflow (acft/mo)
No Project
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding

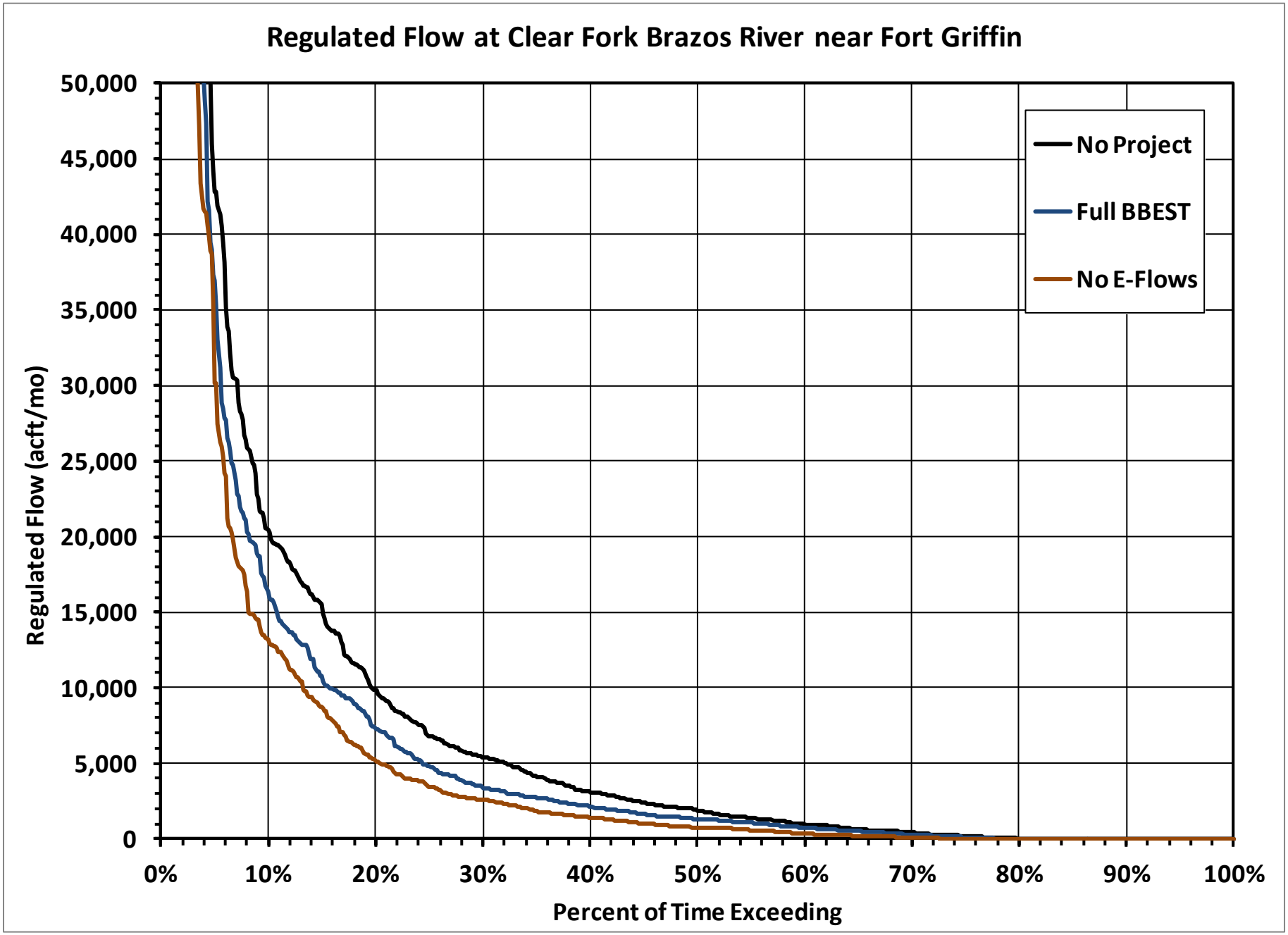

Regulated Flow at Clear Fork Brazos River at CRR Dam
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Streamflow (acft/mo)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding
No Project
Full BBEST
Flow Impounded
Flow dedicated to environment

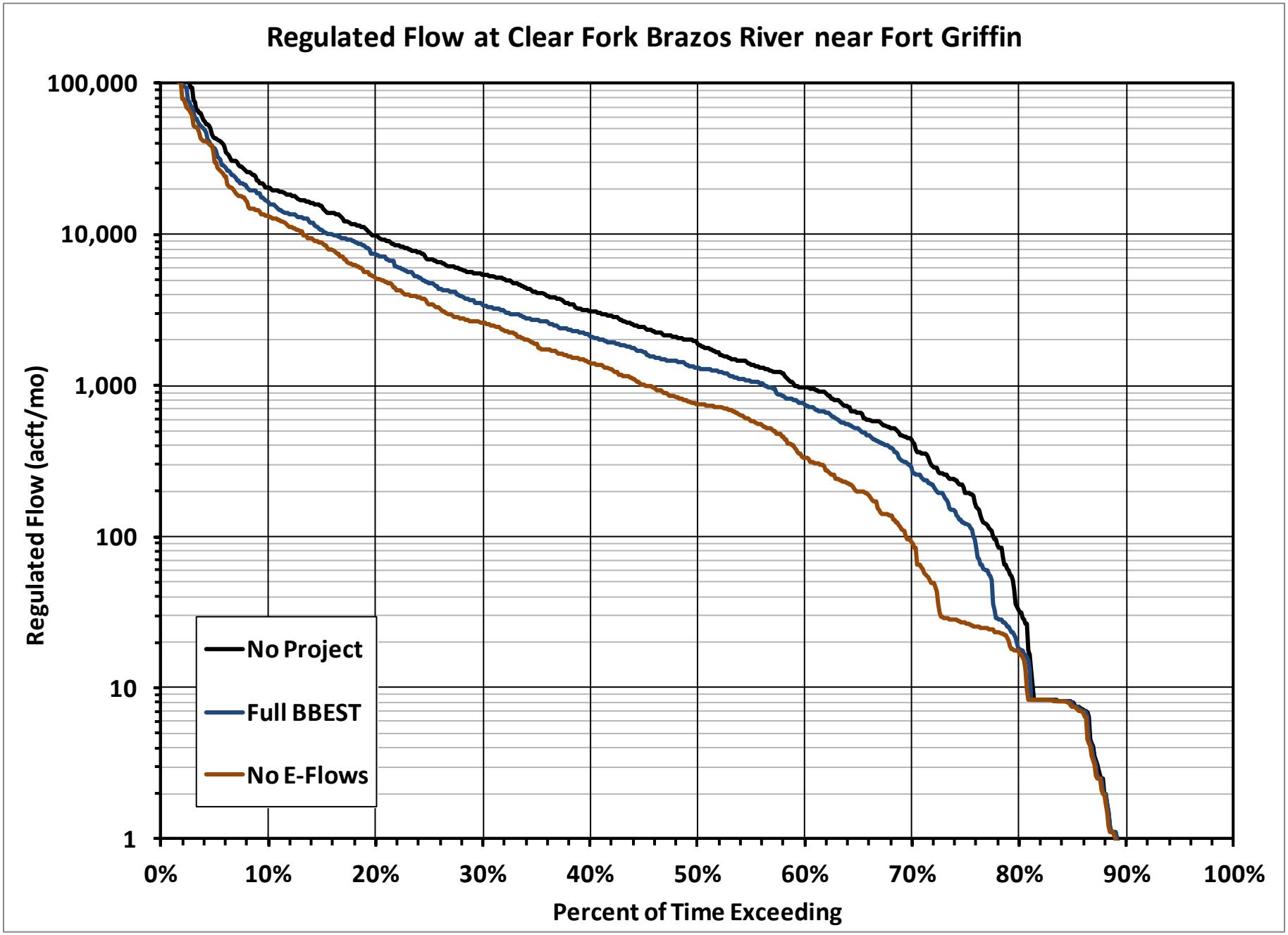

Regulated Flow at Clear Fork Brazos River at CRR Dam
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Streamflow (acft/mo)
No Project
Full BBEST
No E-Flows
Flow dedicated to environment
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding

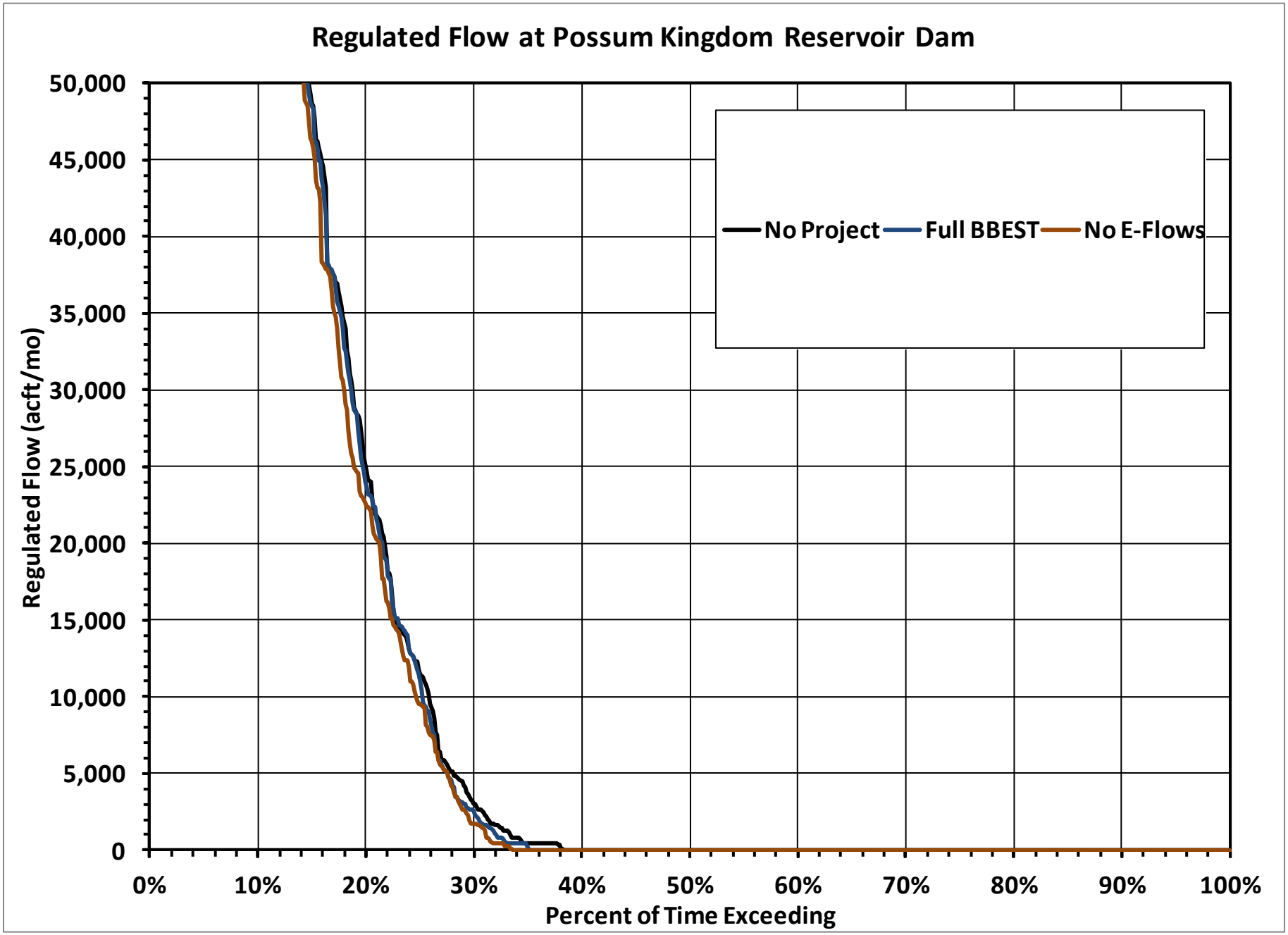

Regulated Flow at Clear Fork Brazos River at CRR Dam
Streamflow (acft/mo)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding
No Project
Full BBEST
No E-Flows

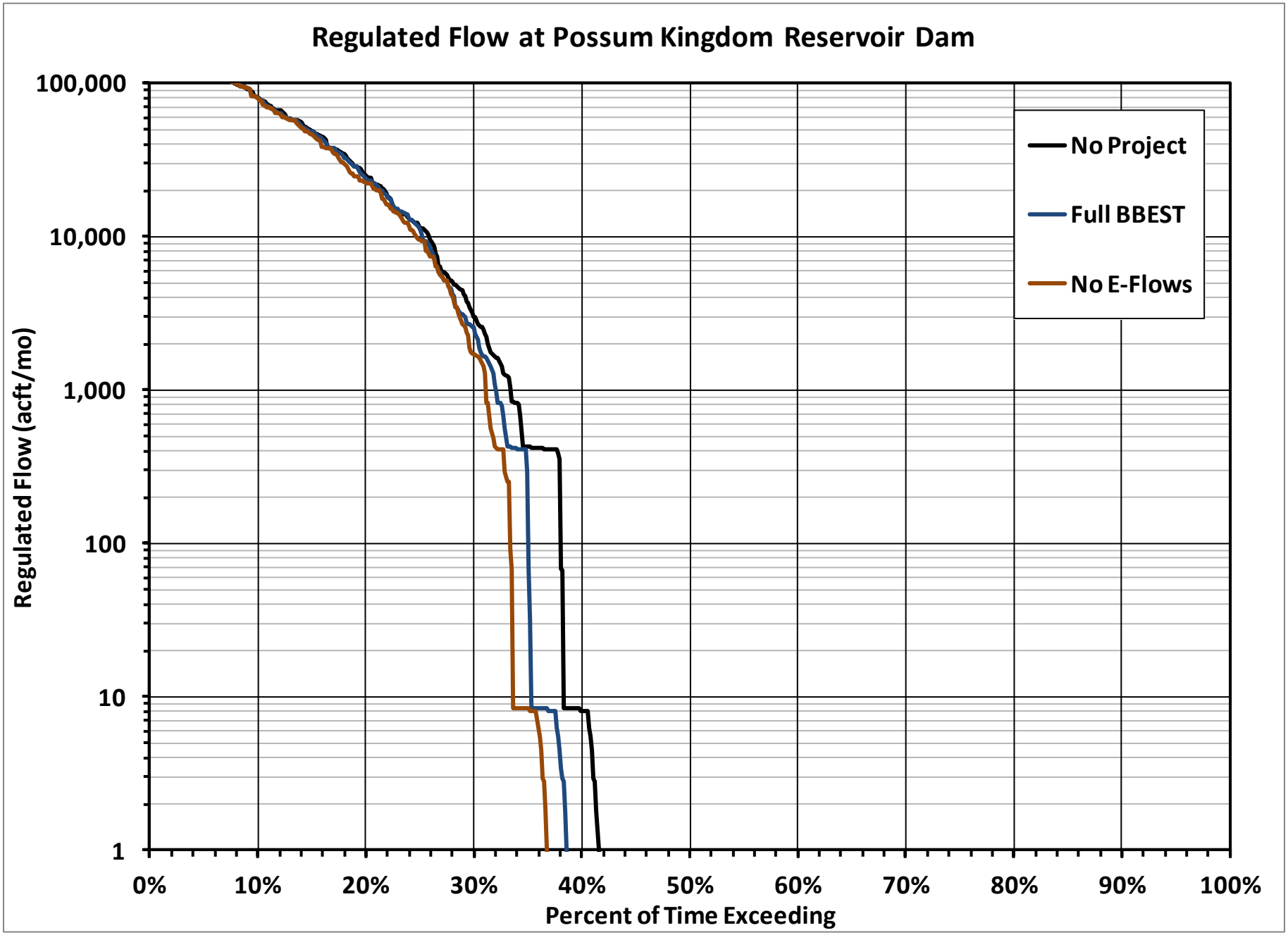
Hydrologic Variance

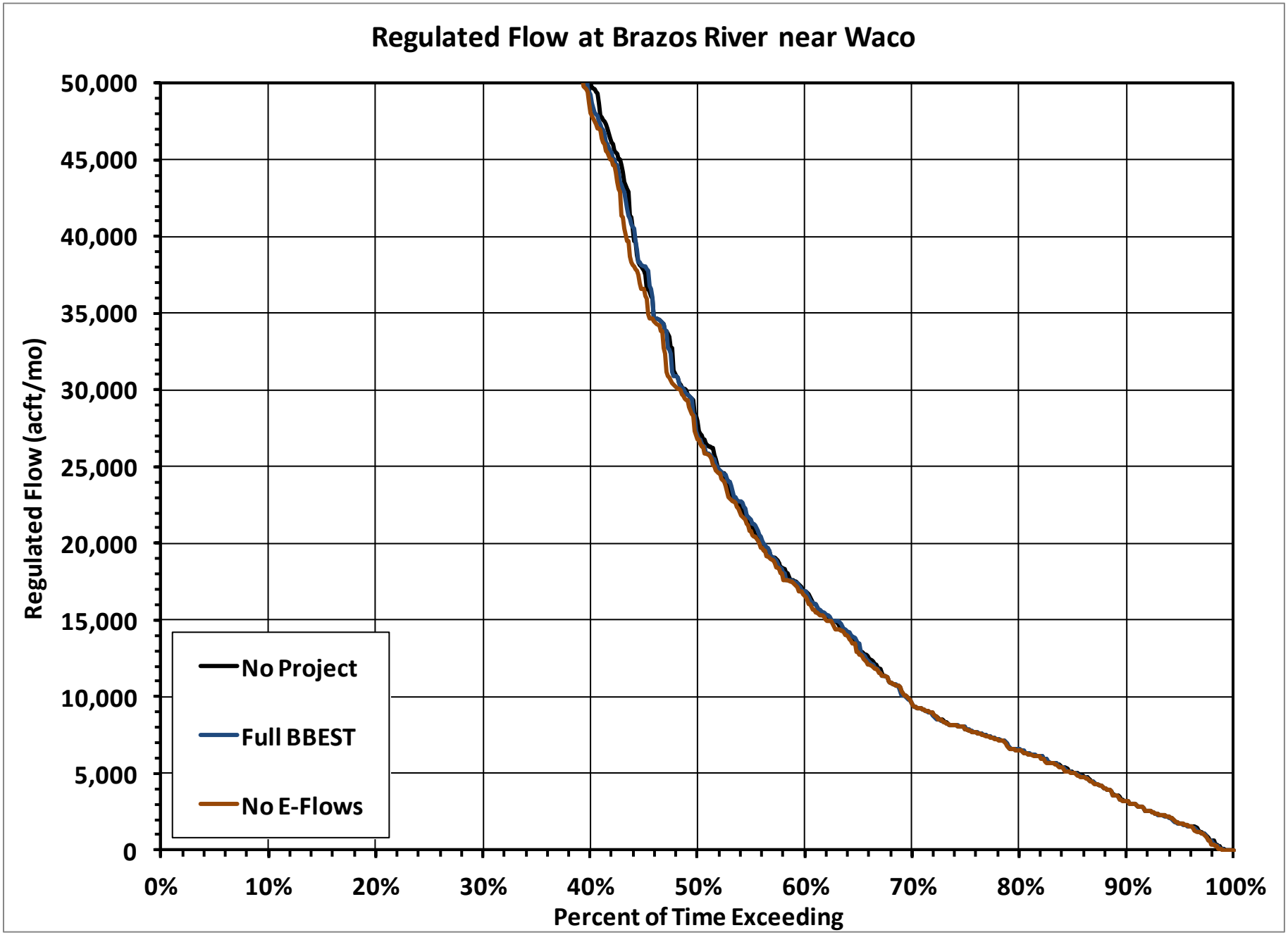
- Days of Zero Flow in 2011
  - CFNU – 77 days (21%)
  - CFFG – 168 days (46%)
- Channel Losses
  - Cedar Ridge to Possum Kingdom = 55%
  - Aspermont to Possum Kingdom = 71%
  - Possum Kingdom to Rosharon = 14%

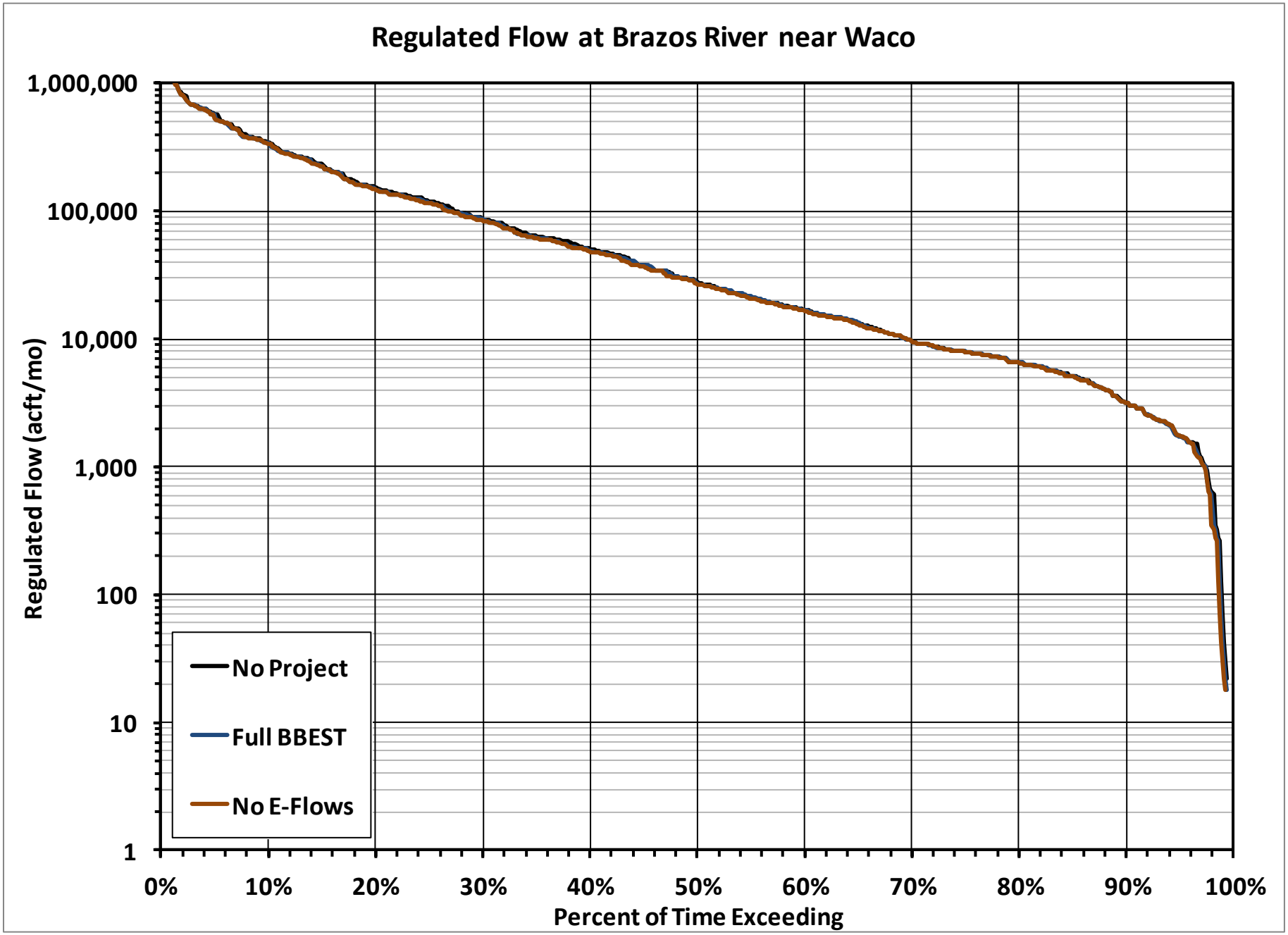

Regulated Flow at Clear Fork Brazos River near Fort Griffin
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Regulated Flow (acft/mo)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding
No Project
Full BBEST
No E-Flows

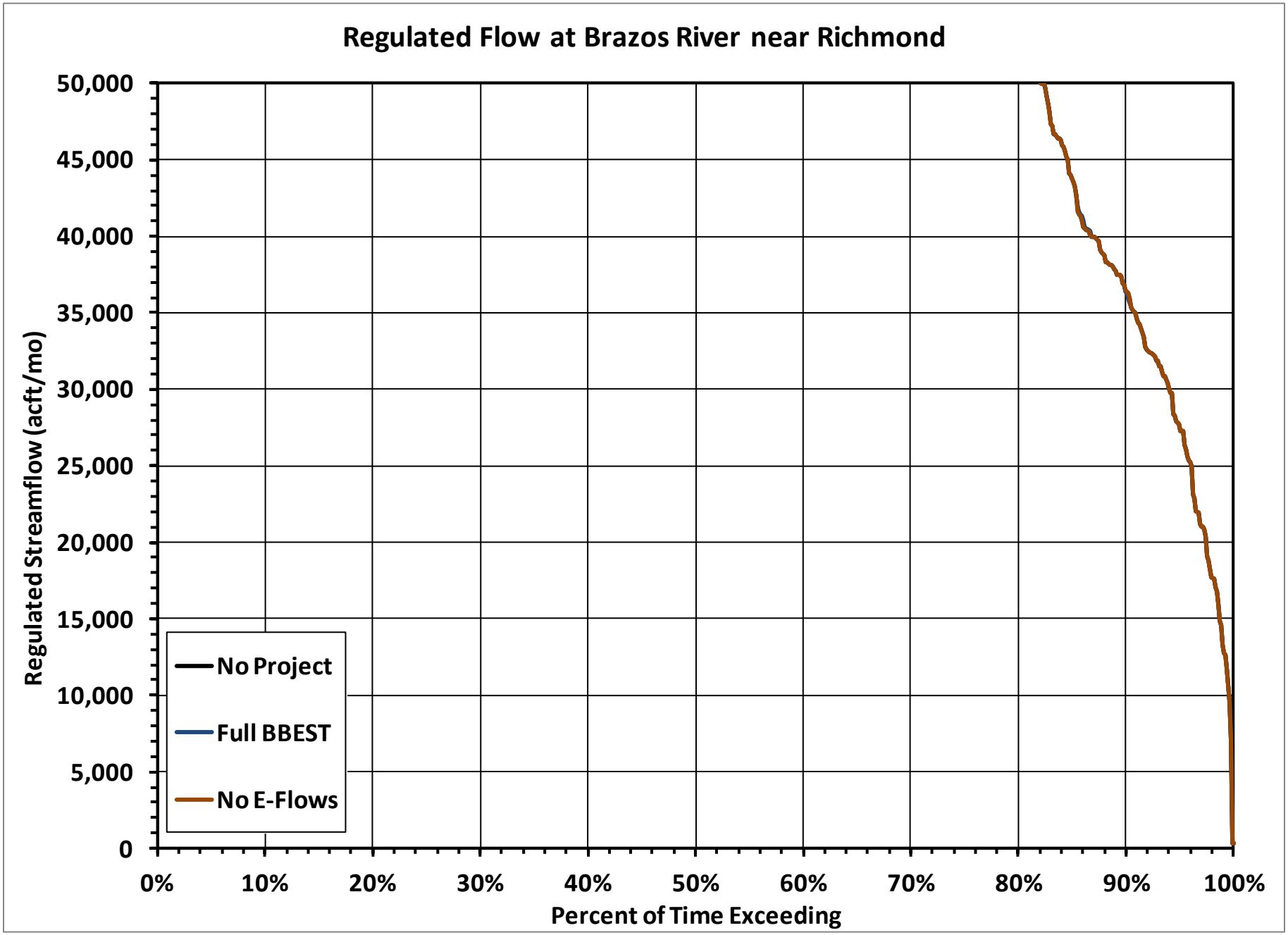

Regulated Flow at Clear Fork Brazos River near Fort Griffin
100,000
10,000
1,000
100
10
1
Regulated Flow (acft/mo)
No Project
Full BBEST
No E-Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding

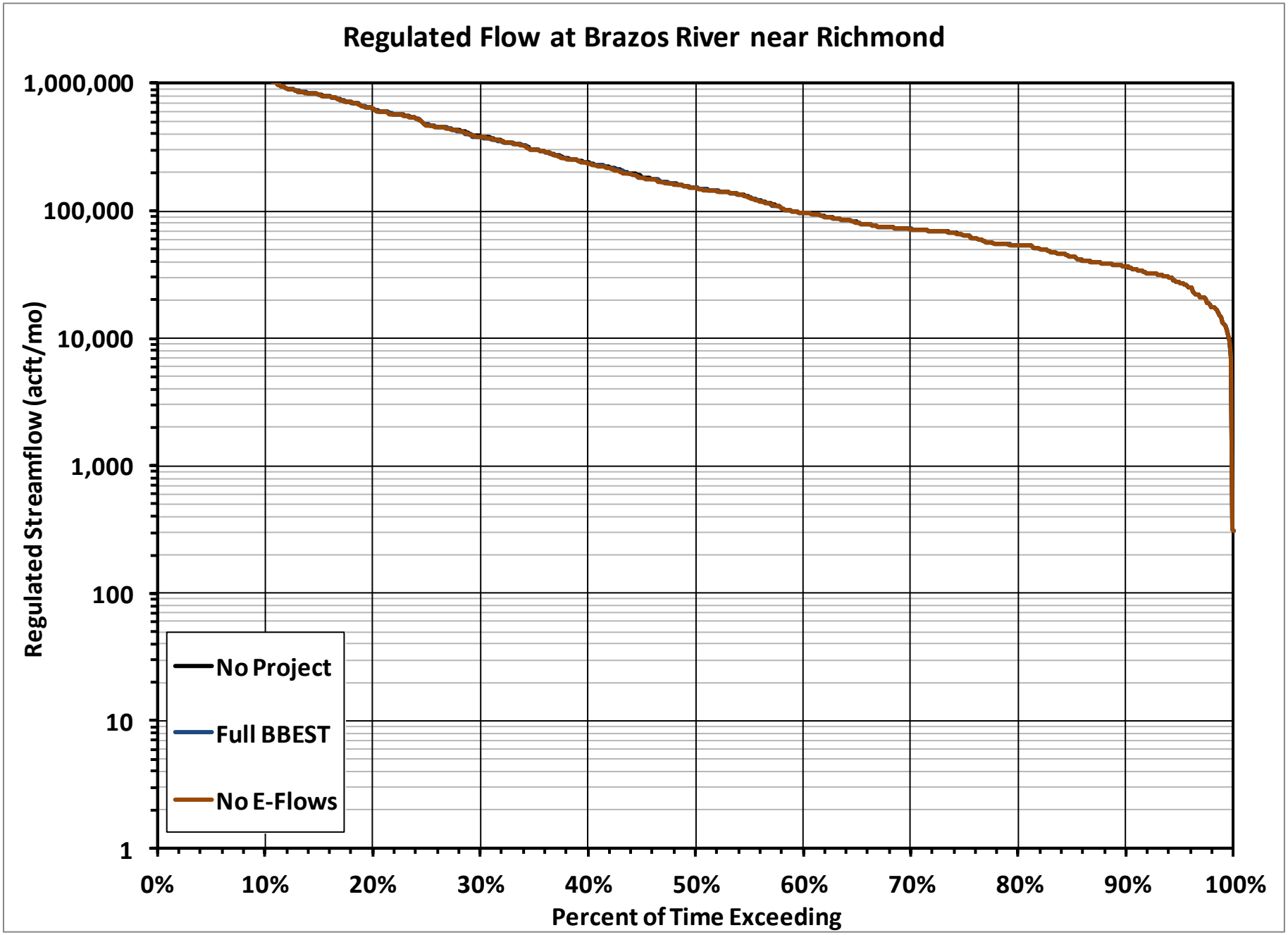

Regulated Flow at Possum Kingdom Reservoir Dam
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Regulated Flow (acft/mo)
No Project
Full BBEST
No E-Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding


Regulated Flow at Possum Kingdom Reservoir Dam
100,000
10,000
1,000
100
10
1
Regulated Flow (acft/mo)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding
No Project
Full BBEST
No E-Flows


Regulated Flow at Brazos River near Waco
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Regulated Flow (acft/mo)
No Project
Full BBEST
No E-Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding


Regulated Flow at Brazos River near Waco
1,000,000
100,000
10,000
1,000
100
10
1
Regulated Flow (acft/mo)
No Project
Full BBEST
No E-Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding


Regulated Flow at Brazos River near Richmond
Regulated Streamflow (acft/mo)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding
No Project
Full BBEST
No E-Flows


Regulated Flow at Brazos River near Richmond
1,000,000
100,000
10,000
1,000
100
10
1
Regulated Streamflow (acft/mo)
No Project
Full BBEST
No E-Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Exceeding